Application 10/569,554
Filing date: 08/19/2004
Inventors: FARRUSSENG David, MIRODATOS Claude, REBEILLEAU Michael, VAN VEEN André, RUSHWORTH Simon and ROUSSET Jean Luc

DECLARATION under 37 C.F.R. § 1.132

The undersigned, David FARRUSSENG of 136H, rue Guillaume de Varey, 69380 BELMONT D'AZERGUES, France, herewith declares as follows :

1. I am an expert in the field of material chemistry. My resume is attached.

2. I am a co-inventor of the U.S. patent application serial number 10/569,554. I am aware of the contents of the pending claims. I have reviewed the Office Actions mailed on 10/23/2008, 01/14/2009 and 07/30/2009, the advisory action dated 12/17/2009 and the prior art cited therein.

3. The invention of the application includes an oxygen conducting membrane, comprising a mixed conducting dense membrane of multimetal oxide, one surface of which is covered with dispersed particles based on magnesium oxide or noble metals,
wherein the mixed conducting dense membrane is a layer comprising a multimetal oxide having the formula:

$$Ba_x Sr_{1-x} Co_{1-y} Fe_y O_{3-z}$$

where $0 \leq x \leq 1$; $0 \leq y \leq 1$ and z is a number which renders the charge of the compound neutral and which defines the oxygen deficiency, and
wherein the particles based on magnesium oxide or noble metals represent from 0.01 to 0.1% by weight of the dense membrane.

4. The claimed oxygen conducting membrane differs from the one of Chen et *al.* by the nature of the multimetal oxide and by the weight ratio of metal or metal oxide compared to the one of the dense membrane of Chen *et al.* (US 6,187,157).

5. The claimed oxygen conducting membrane is not obvious in view of the teaching of Chen *et al.* or in view of the teaching of Chen *et al.* combined with the teaching of Hazbun (US 4,791,079).

6. The claimed membranes advantageously exhibit better oxygen fluxes than membranes of the prior art. The claimed membranes usually allow an increase of the permeation flow of the oxygen, generally of between 5 and 20%, and advantageously in the order of 30% (p. 9, 3rd par.of the present application).

7. I declare that all statements made in the enclosed article by Olivier et al. (Catalysis today, 2009, vol. 142, n° 1-2 pp. 34-41) of my knowledge are true. Table 1 describes a 1 mm thick Pt/MgO coated $Ba_{0,5}Sr_{0,5}Co_{0,8}Fe_{0,2}O_{3-z}$ membrane (table 1, p. 36). The exemplified membrane contains 7.2 mg of Pt/MgO (table 1) for approximately 0.5 g

perovskite (p. 35, col. 1 "membrane materials"), i.e. about 0.014%wt of Pt/MgO. This membrane responds to the definition of the claimed membrane. As reported in table 1, the oxygen flux at 900°C of such a membrane is 2,84 mL/cm^2 min.

8. This oxygen flux is 40% higher than the best oxygen flux reported in Chen *et al.*, which describes that the oxygen flux at 900°C of the membrane of example 1 (Ag coated $La_{0,05}$ $Sr_{0,95}$ Co O_{3-x}) is 2 mL/cm^2 min (from figure 4, for a 1 mm thickness) and the one of example 3 (50Pd/50Ag coated $Ce_{0,8}$ $Gd_{0,2}$ O_{2-x}) is 0,06 mL/cm^2 min.

9. This demonstrates that the claimed oxygen conducting membrane exhibits <u>better oxygen fluxes</u> than the membranes of Chen *et al.*

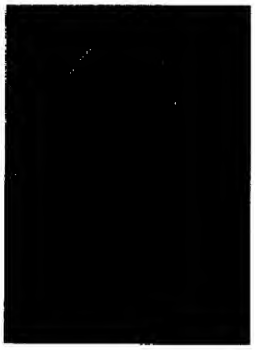
10. Said improvement of the oxygen fluxes by using a membrane as claimed could not have been foreseen from the teaching of Chen *et al.* taken alone or in combination with that of Hazbun *et al.*

11. The undersigned declares further that all statements made herein of his knowledge are true and that all statements made on information and belief are believed to be true. Further that these statements were made with the knowledge that wilfully false statements and the like so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code, and that such wilfully false statements may jeopardize the validity of the application and of any patent issued thereon.

Signed this 18 day of January 2010.

David FARRUSSENG

David Farrusseng



Born in 1972 at Montpellier, France
Married, three children

1994 Master I at Montpellier University
1994 Stay at Heidelberg University, Prof W. Siebert, *Titanocene synthesis*
1995 Master II, Montpellier University, Prof. R. Corriu, *Alkoxysilane synthesis*
1996-1999 PhD thesis, Institut Européen des Membranes (Univ. Montpellier) – Supervisors: Christian Guizard & Anne Julbe -*Catalytic membranes for the partial oxidation of alkanes*.
2000 Post-Doc at Max Planck Institute für Kohlenforschung, Prof. Ferdi Schueth, Synthesis of micro & mesoporous silicon nitride for basic catalysis
2001 Permanent staff at Institut de Recherches Catalyse (IRCELYON), Lyon, Fance
2010 Group leader at IRCELYON/CNRS

Selected papers

A comparative study of $La_{0.8}Sr_{0.2}MnO_3$ and $La_{0.8}Sr_{0.2}Sc_{0.1}Mn_{0.9}O_3$ as cathode materials of single-chamber SOFCs operating on a methane–air mixture
Journal of Power Sources, 2009, 191(2): p. 225-232.

Metal-Organic Frameworks: State of the Art and Opportunities for Catalysis
Ang. Chem. Int. Ed., 2009, 48(41): p. 7502-7513.

A new symmetric solid-oxide fuel cell with $La_{0.8}Sr_{0.2}Sc_{0.2}Mn_{0.8}O_{3-d}$ perovskite oxide as both the anode and cathode
Acta Materiala, 2008, 57(4): p. 1165-1175.

High Throughput Experimentation in heterogeneous Catalysis
Surface Science Reports, 2008, 63(11): p. 487-513.

Limitations and potentials of oxygen transport dense and porous ceramic membranes for oxidation reactions
Catalysis Today, 2005, 104(2-4): p. 102-113.

Pore-size engineering of silicon imido nitride for catalytic applications
Angewandte Chemie-International Edition, 2001,. 40(22): p. 4204-4207.

The first redox switchable ceramic membrane
Journal of the American Chemical Society, 2000, 122(50): p. 12592-12593.

Scientific outcome

9 plenary invited lectures in international conferences, 25 oral presentation in international conferences, 60 publications in international journals, 8 patents (1 exploited), 2 software, 4 book chapters, board member of *CCHTS*, more than 110 conference proceedings, and more than 600 citations.

Awards and Honours

1995 Grant assigned to for best students
1999 Award for outstanding PhD work, Montpellier University
2007 DivCat Annual Award of the Catalyst Division of French Chemical Society